



WINSTAR Display Co.,Ltd.
華凌光電股份有限公司



Winstar Display Co., LTD
華凌光電股份有限公司

WEB: <http://www.winstar.com.tw> E-mail: sales@winstar.com.tw



SPECIFICATION

CUSTOMER : _____

MODULE NO.: **WF35LTIBCDANO#**

| | |
|--|---|
| APPROVED BY: (FOR CUSTOMER USE ONLY) | PCB VERSION: DATA: |
|--|---|

| SALES BY | APPROVED BY | CHECKED BY | PREPARED BY |
|-------------------------|-------------|------------|-------------|
| | | | 葉虹蘭 |
| ISSUED DATE: 2017/06/14 | | | |

RECORDS OF REVISION

DOC. FIRST ISSUE

| VERSION | DATE | REVISED PAGE NO. | SUMMARY |
|---------|------------|---------------------|---|
| 0 | 2013/09/04 | | First issue |
| A | 2014/05/07 | | Modify Package Specification. |
| B | 2014/07/18 | | Modify frame. |
| C | 2015/08/10 | | Add size & Surface. Modify Pixel Data Format & Block Diagram& Static electricity test. |
| D | 2016/01/21 | | Modify Static electricity test |
| E | 2016/08/10 | | Modify Vibration test. Remove Package Specification |
| F | 2016/10/05 | | Modify Summary Add Aspect Ratio |
| G | 2017/03/30 | | Modify Contour Drawing. |
| H | 2017/06/14 | | Modify FPC. |

Contents

- 1.Module Classification Information
- 2.Summary
- 3.General Specification
- 4.Absolute Maximum Ratings
- 5.Electrical Characteristics
- 6.DC Characteristics
- 7.Interface Timing Characteristics
- 8.Optical Characteristics
- 9.Interface
- 10.Block Diagram
- 11.Reliability
- 12.Contour Drawing
- 13.Initial Code For Reference

1.Module Classification Information

W F 35 L T I B C D A N 0 #
 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬

| | | | | | | | | | | | | |
|---|---|---------|---|---------|---|---------|---|--|---|---------|---|---------|
| ① | Brand : WINSTAR DISPLAY CORPORATION | | | | | | | | | | | |
| ② | Display Type : F→TFT Type, J→Custom TFT | | | | | | | | | | | |
| ③ | Display Size : 3.5” TFT | | | | | | | | | | | |
| ④ | Model serials no. | | | | | | | | | | | |
| ⑤ | Backlight Type : | | F→CCFL, White S→LED, High Light White | | | | | T→LED, White Z→Nichia LED, White | | | | |
| ⑥ | LCD Polarize Type/ Temperature range/ Gray Scale Inversion Direction | | A→Transmissive, N.T, IPS TFT C→Transmissive, N. T, 6:00 ; F→Transmissive, N.T,12:00 ; I→Transmissive, W. T, 6:00 K→Transflective, W.T,12:00 L→Transmissive, W.T,12:00 N→Transmissive, Super W.T, 6:00 | | | | | Q→Transmissive, Super W.T, 12:00 R→Transmissive, Super W.T, O-TFT V→Transmissive, Super W.T, VA TFT X→Transmissive, W.T, VA TFT Y→Transmissive, W.T, IPS TFT Z→Transmissive, W.T, O-TFT | | | | |
| ⑦ | A : TFT LCD B : TFT+FR+CONTROL BOARD C : TFT+FR+A/D BOARD D : TFT+FR+A/D BOARD+CONTROL BOARD E : TFT+FR+POWER BOARD | | | | | | | F : TFT+CONTROL BOARD G : TFT+FR H : TFT+D/V BOARD I : TFT+FR+D/V BOARD J : TFT+POWER BD | | | | |
| ⑧ | Resolution: | | | | | | | | | | | |
| | A | 128160 | B | 320234 | C | 320240 | D | 480234 | E | 480272 | F | 640480 |
| | G | 800480 | H | 1024600 | I | 320480 | J | 240320 | K | 800600 | L | 240400 |
| | M | 1024768 | N | 128128 | P | 1280800 | Q | 480800 | R | 640320 | S | 480128 |
| | T | 800320 | U | 8001280 | V | 176220 | W | 1280398 | X | 1024250 | Y | 1920720 |
| | Z | 800200 | 2 | 1024324 | 3 | 7201280 | | | | | | |
| ⑨ | D: Digital L : LVDS M:MIPI | | | | | | | | | | | |
| ⑩ | Interface : N:without control board A:8Bit B:16Bit H: HDMI I:I2C Interface R:RS232 S:SPI Interface U:USB | | | | | | | | | | | |
| ⑪ | TS : N : Without TS T : resistive touch panel C : capacitive touch panel (G-F-F) G : capacitive touch panel(G-G) | | | | | | | | | | | |
| ⑫ | Version | | | | | | | | | | | |
| ⑬ | Special Code | | #:Fit in with ROHS directive regulations | | | | | | | | | |

2.Summary

TFT 3.5" is a TN transmissive type color active matrix TFT liquid crystal display that uses amorphous silicon TFT as switching devices. This module is composed of a TFT_LCD module. It is usually designed for industrial application and this module follows RoHS.

3.General Specifications

| Item | Dimension | Unit |
|--------------------------------|-----------------------------------|------|
| Size | 3.5 | inch |
| Dot Matrix | 320 x RGBx240(TFT) | dots |
| Module dimension | 93.50(W) x 66.44(H) x 7.3(D) | mm |
| Active area | 70.08 x 52.56 | mm |
| Dot pitch | 0.219 x 0.073 | mm |
| LCD type | TFT, Normally White, Transmissive | |
| View Direction | 12 o'clock | |
| Gray Scale Inversion Direction | 6 o'clock | |
| Aspect Ratio | 4:3 | |
| Backlight Type | LED, Normally White | |
| Controller IC | SSD1963 | |
| Interface | Digital 8080 family MPU | |
| With /Without TP | Without TP | |
| Surface | Anti-Glare | |

*Color tone slight changed by temperature and driving voltage.

4. Absolute Maximum Ratings

| Item | Symbol | Min | Typ | Max | Unit |
|-----------------------|--------|-----|-----|-----|------|
| Operating Temperature | TOP | -20 | — | +70 | °C |
| Storage Temperature | TST | -30 | — | +80 | °C |

Note: Device is subject to be damaged permanently if stresses beyond those absolute maximum ratings listed above

1. Temp. $\leq 60^{\circ}\text{C}$, 90% RH MAX. Temp. $> 60^{\circ}\text{C}$, Absolute humidity shall be less than 90% RH at 60°C

5. Electrical Characteristics

5.1. Operating conditions:

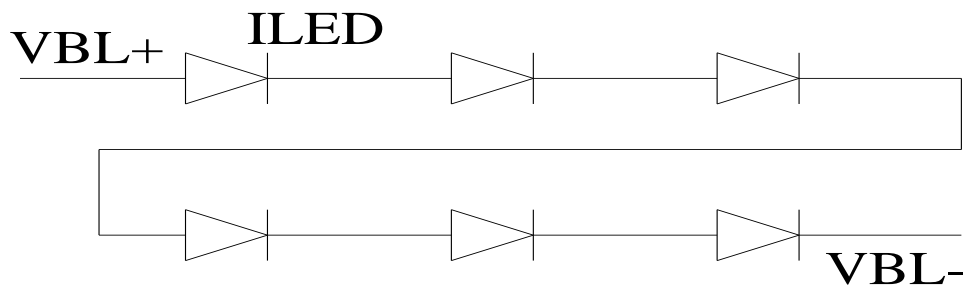
| Item | Symbol | Condition | Min | Typ | Max | Unit | Remark |
|------------------------|--------|-----------|-----|------|------|------|----------|
| Supply Voltage For LCM | VDD | - | 3.0 | 3.3 | 3.6 | V | - |
| Power Supply For LCM | IDD | - | - | 310 | 470 | mA | Note1 |
| Power Consumption | - | - | - | 1020 | 1690 | mW | VDD=3.3V |

Note 1 : This value is test for VDD=3.3V , Ta=25 °C only

5.2. LED driving conditions

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------|--------|------|--------|------|------|------------|
| LED current | - | - | 20 | - | mA | - |
| Power Consumption | - | 348 | 384 | 408 | mW | - |
| LED voltage | VBL+ | 17.4 | 19.2 | 20.4 | V | Note 1 |
| LED Life Time | - | - | 50,000 | - | Hr | Note 2,3,4 |

Note 1 : There are 1 Groups LED



Note 2 : Ta = 25 °C

Note 3 : Brightness to be decreased to 50% of the initial value

Note 4 : The single LED lamp case

6.DC CHARATERISTICS

| Parameter | Symbol | Rating | | | Unit | Condition |
|--------------------------|----------|--------|-----|--------|------|-----------|
| | | Min | Typ | Max | | |
| Low level input voltage | V_{IL} | 0 | - | 0.3VDD | V | |
| High level input voltage | V_{IH} | 0.7VDD | - | VDD | V | |

7.Interface timing

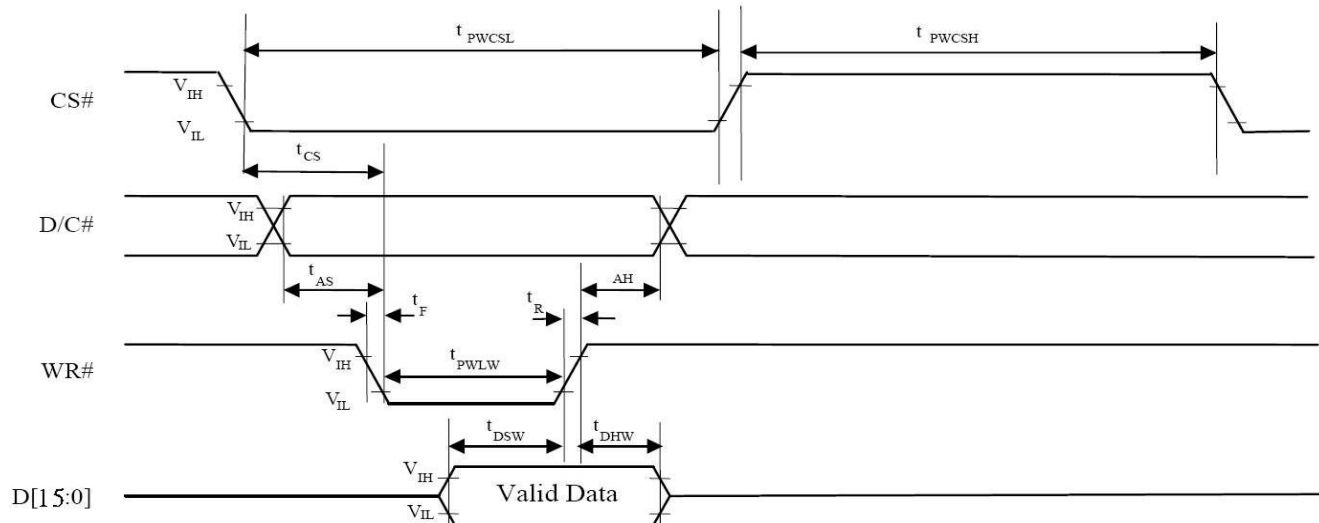
7.1. 8080 Mode

The 8080 mode MCU interface consist of CS#, D/C#, RD#, WR#, Data bus. This interface use WR# to define a write cycle and RD# for read cycle. If the WR# goes low when the CS# signal is low, the data or command will be latched into the system at the rising edge of WR#. Similarly, the read cycle will start when RD# goes low and end at the rising edge of RD#.

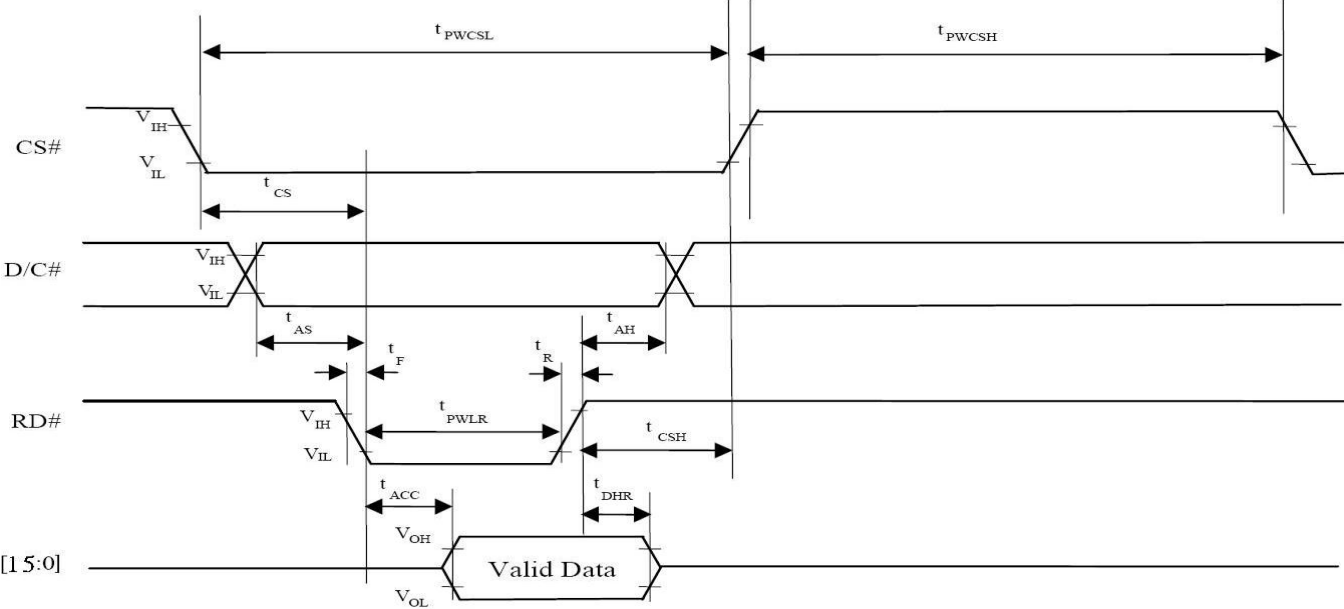
7.2. 8080 Mode Write Cycle

| Symbol | Parameter | Min | Typ | Max | Unit |
|--------|--|----------------|------------------------------------|-----|------|
| fMCLK | System Clock Frequency | 1 | — | 110 | MHz |
| tMCLK | System Clock Period | 1/ fMCLK | — | — | ns |
| tPWCSH | Control Pulse High Width Write Read | 13 30 | 1.5* tMCLK 3.5* tMCLK | — | ns |
| tPWCSL | Control Pulse Low Width Write (next write cycle) Write (next read cycle) Read | 13 80 80 | 1.5* tMCLK 9* tMCLK 9* tMCLK | — | ns |
| tAS | Address Setup Time | 1 | — | — | ns |
| tAH | Address Hold Time | 2 | — | — | ns |
| tDSW | Write Data Setup Time | 4 | — | — | ns |
| tDHW | Write Data Hold Time | 1 | — | — | ns |
| tPWLW | Write Low Time | 12 | — | — | ns |
| tDHR | Read Data Hold Time | 1 | — | — | ns |
| tACC | Access Time | 32 | — | — | ns |
| tPWLR | Read Low Time | 36 | — | — | ns |
| tR | Rise Time | — | — | 0.5 | ns |
| tF | Fall Time | — | — | 0.5 | ns |
| tCS | Chip select setup time | 2 | — | — | ns |
| tCSH | Chip select hold time to read signal | 3 | — | — | ns |

7.3. Parallel 8080-series Interface Timing Diagram(Write Cycle)



7.4. Parallel 8080-series Interface Timing Diagram (Read Cycle)



7.5. Pixel Data Format

| Interface | Cycle | D[15] | D[14] | D[13] | D[12] | D[11] | D[10] | D[9] | D[8] | D[7] | D[6] | D[5] | D[4] | D[3] | D[2] | D[1] | D[0] |
|----------------------|-----------------|-------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|------|------|------|
| 16 bits (565 format) | 1 st | R5 | R4 | R3 | R2 | R1 | G5 | G4 | G3 | G2 | G1 | G0 | B5 | B4 | B3 | B2 | B1 |
| 16 bits | 1 st | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 |
| | 2 nd | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 |
| | 3 rd | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |
| 8 bits | 1 st | | | | | | | | | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 |
| | 2 nd | | | | | | | | | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 |
| | 3 rd | | | | | | | | | B7 | B6 | B5 | B4 | B3 | B2 | B1 | B0 |

8.Optical Characteristics

| Item | Symbol | Condition. | Min | Typ. | Max. | Unit | Remark |
|---|--------|---|------|------|------|-------------------|-------------------|
| Response time | Tr | $\theta = 0^\circ \cdot \Phi = 0^\circ$ | - | 10 | - | ms | Note 3,5 |
| | Tf | | - | 15 | - | ms | |
| Contrast ratio | CR | At optimized viewing angle | 300 | 350 | - | - | Note 4,5 |
| Color Chromaticity | White | $\theta = 0^\circ \cdot \Phi = 0^\circ$ | 0.26 | 0.31 | 0.36 | - | Note 2,6,7 |
| | Wy | | 0.28 | 0.33 | 0.38 | - | - |
| Viewing angle (Gray Scale Inversion Direction) | Hor. | Θ_R | - | 55 | - | Deg. | Note 1 |
| | | Θ_L | - | 55 | - | | |
| | Ver. | Φ_T | - | 45 | - | | |
| | | Φ_B | - | 50 | - | | |
| Brightness | - | - | 350 | 420 | - | cd/m ² | Center of display |

Ta=25±2°C, IL=20mA

Note 1: Definition of viewing angle range

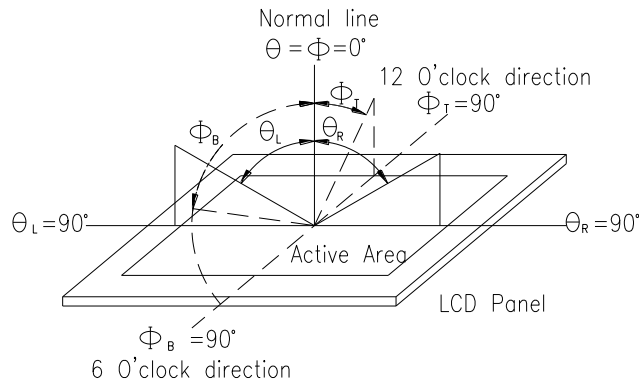


Fig. 8.1. Definition of viewing angle

Note 2: Test equipment setup:

After stabilizing and leaving the panel alone at a driven temperature for 10 minutes, the measurement should be executed. Measurement should be executed in a stable, windless, and dark room. Optical specifications are measured by Topcon BM-7 or BM-5 luminance meter 1.0° field of view at a distance of 50cm and normal direction.

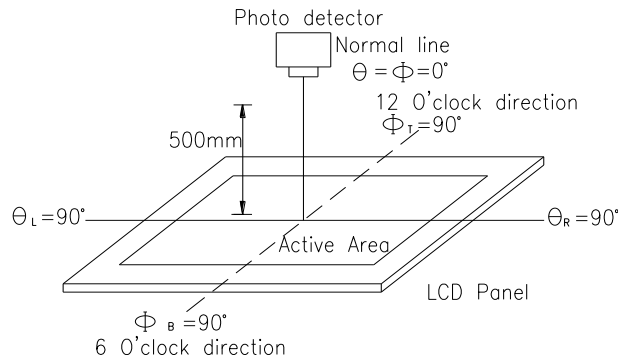
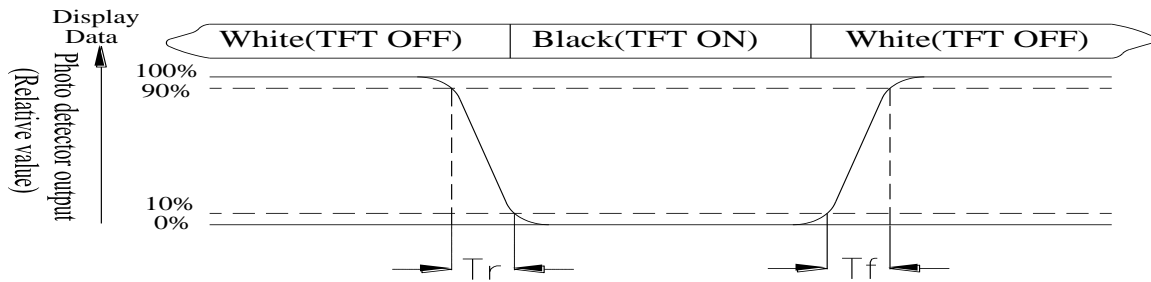


Fig. 8.2. Optical measurement system setup

Note 3: Definition of Response time:

The response time is defined as the LCD optical switching time interval between “White” state and “Black” state. Rise time, T_r , is the time between photo detector output intensity changed from 90% to 10%. And fall time, T_f , is the time between photo detector output intensity changed from 10% to 90%



Note 4: Definition of contrast ratio:

The contrast ratio is defined as the following expression.

$$\text{Contrast ratio (CR)} = \frac{\text{Luminance measured when LCD on the "White" state}}{\text{Luminance measured when LCD on the "Black" state}}$$

Note 5: White $V_i = V_{i50} \pm 1.5V$

Black $V_i = V_{i50} \pm 2.0V$

“ \pm ” means that the analog input signal swings in phase with VCOM signal.

“ \pm ” means that the analog input signal swings out of phase with VCOM signal.

The 100% transmission is defined as the transmission of LCD panel when all the input terminals of module are electrically opened.

Note 6: Definition of color chromaticity (CIE 1931)

Color coordinates measured at the center point of LCD

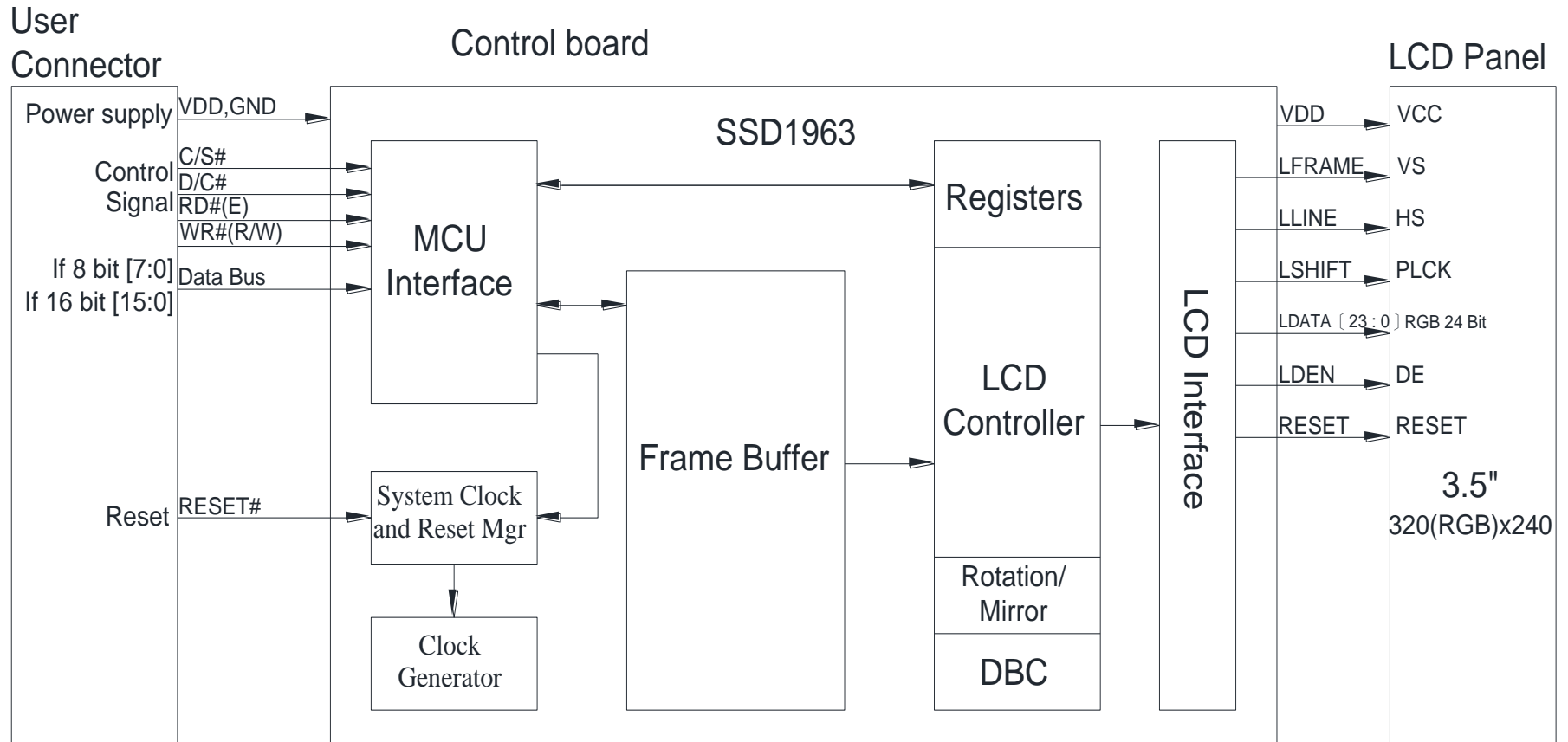
Note 7: Measured at the center area of the panel when all the input terminals of LCD panel are electrically opened.

9.Interface

9.1. LCM PIN Definition

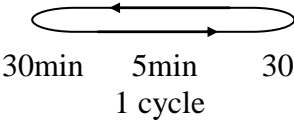
| Pin | Symbol | Function | Remark |
|-----|--------|--|--------|
| 1 | GND | System ground pin of the IC. Connect to system ground. | |
| 2 | VDD | Power Supply : +3.3V | |
| 3 | BL_E | Backlight control signal , H: On \ L:Off | |
| 4 | D/C | Data/Command select | |
| 5 | WR | Write strobe signal | |
| 6 | RD | Read strobe signal | |
| 7 | DB0 | Data bus | |
| 8 | DB1 | Data bus | |
| 9 | DB2 | Data bus | |
| 10 | DB3 | Data bus | |
| 11 | DB4 | Data bus | |
| 12 | DB5 | Data bus | |
| 13 | DB6 | Data bus | |
| 14 | DB7 | Data bus | |
| 15 | CS | Chip select | |
| 16 | RES | Hardware reset | |
| 17 | NC | No connect | |
| 18 | NC | No connect | |
| 19 | NC | No connect | |
| 20 | NC | No connect | |

10. Block Diagram



11.Reliability

Content of Reliability Test (Wide temperature, -20°C~70°C)

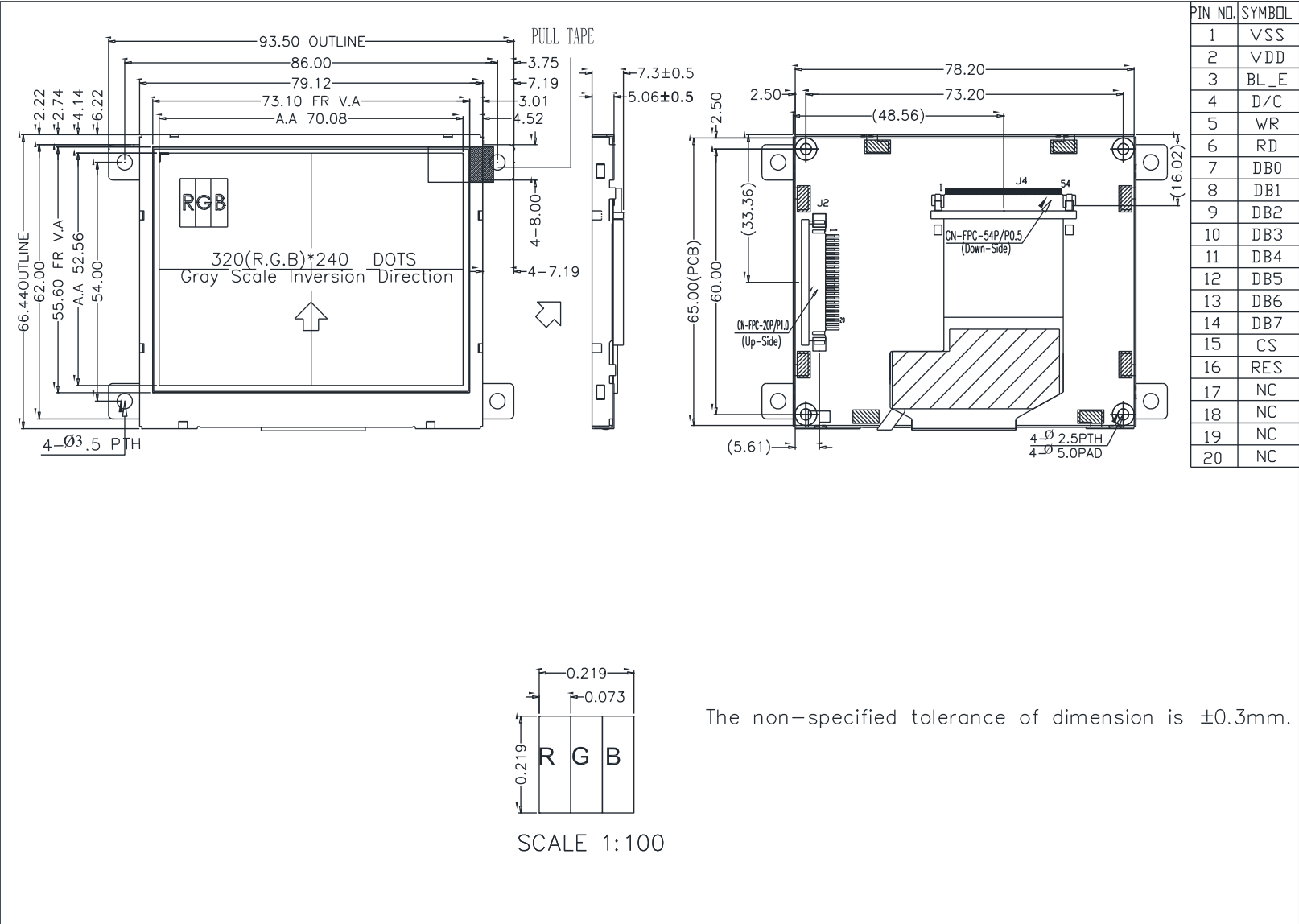
| Environmental Test | | | |
|---|---|---|------|
| Test Item | Content of Test | Test Condition | Note |
| High Temperature storage | Endurance test applying the high storage temperature for a long time. | 80°C 200hrs | 2 |
| Low Temperature storage | Endurance test applying the low storage temperature for a long time. | -30°C 200hrs | 1,2 |
| High Temperature Operation | Endurance test applying the electric stress (Voltage & Current) and the thermal stress to the element for a long time. | 70°C 200hrs | — |
| Low Temperature Operation | Endurance test applying the electric stress under low temperature for a long time. | -20°C 200hrs | 1 |
| High Temperature/ Humidity Operation | The module should be allowed to stand at 60 °C,90%RH max | 60°C,90%RH 96hrs | 1,2 |
| Thermal shock resistance | <p>The sample should be allowed stand the following 10 cycles of operation</p> <p style="text-align: center;">-20°C 25°C 70°C</p>  <p style="text-align: center;">30min 5min 30min</p> <p style="text-align: center;">1 cycle</p> | -20°C/70°C 10 cycles | — |
| Vibration test | Endurance test applying the vibration during transportation and using. | Total fixed amplitude : 1.5mm Vibration Frequency : 10~55Hz One cycle 60 seconds to 3 directions of X,Y,Z for Each 15 minutes | 3 |
| Static electricity test | Endurance test applying the electric stress to the terminal. | VS=±600V(contact), ±800v(air), RS=330Ω CS=150pF 10 times | — |

Note1: No dew condensation to be observed.

Note2: The function test shall be conducted after 4 hours storage at the normal Temperature and humidity after remove from the test chamber.

Note3: The packing have to including into the vibration testing.

12.Contour Drawing



13.Initial Code For Reference

```
void Initial_SSD1963()
{
```

```
    Write_Command(0x01);
    Delay_ms(10);
    Write_Command(0xe0);
    Write_Parameter(0x01);
    Delay_ms(5);
    Write_Command(0xe0);
    Write_Parameter(0x03);
    Delay_ms(5);
```

```
    Write_Command(0xb0);
    Write_Parameter(0x0c);
    Write_Parameter(0x80);
    Write_Parameter(0x01);
    Write_Parameter(0x3f);
    Write_Parameter(0x00);
    Write_Parameter(0xef);
    Write_Parameter(0x00);
```

```
    Write_Command(0xf0);
    Write_Parameter(0x00);
```

```
    Write_Command(0xe2);
    Write_Parameter(0x1d);
    Write_Parameter(0x02);
    Write_Parameter(0x54);
```

```
    Write_Command(0xe6);
    Write_Parameter(0x00);
    Write_Parameter(0xdd);
    Write_Parameter(0xde);
```

```
    Write_Command(0xb4);
    Write_Parameter(0x01);
    Write_Parameter(0x98);
    Write_Parameter(0x00);
    Write_Parameter(0x44);
    Write_Parameter(0x14);
    Write_Parameter(0x00);
    Write_Parameter(0x00);
    Write_Parameter(0x00);
```

```
    Write_Command(0xb6);
    Write_Parameter(0x01);
    Write_Parameter(0x06);
    Write_Parameter(0x00);
```

Write_Parameter(0x12);
Write_Parameter(0x04);
Write_Parameter(0x00);
Write_Parameter(0x00);

Write_Command(0x2a);
Write_Parameter(0x00);
Write_Parameter(0x00);
Write_Parameter(0x01);
Write_Parameter(0x3f);

Write_Command(0x2b);
Write_Parameter(0x00);
Write_Parameter(0x00);
Write_Parameter(0x00);
Write_Parameter(0xef);

Write_Command(0x29);
Write_Command(0x2c);

}

**1、Panel Specification :**

- | | | |
|----------------------------|-------------------------------|-------------------------------------|
| 1. Panel Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. View Direction : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Numbers of Dots : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. View Area : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Active Area : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Operating Temperature : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Storage Temperature : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. Others : | _____ | |

2、Mechanical Specification :

- | | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 1. PCB Size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Frame Size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Material of Frame : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Connector Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Fix Hole Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Backlight Position : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Thickness of PCB : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. Height of Frame to PCB : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 9. Height of Module : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 10. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

3、Relative Hole Size :

- | | | |
|-----------------------------|-------------------------------|-------------------------------------|
| 1. Pitch of Connector : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Hole size of Connector : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Mounting Hole size : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Mounting Hole Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

4、Backlight Specification :

- | | | |
|---|-------------------------------|-------------------------------------|
| 1. B/L Type : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. B/L Color : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. B/L Driving Voltage (Reference for LED Type) : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. B/L Driving Current : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. Brightness of B/L : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. B/L Solder Method : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

>> **Go to page 2** <<



5、Electronic Characteristics of Module :

- | | | |
|------------------------------|-------------------------------|-------------------------------------|
| 1. Input Voltage : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 2. Supply Current : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 3. Driving Voltage for LCD : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 4. Contrast for LCD : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 5. B/L Driving Method : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 6. Negative Voltage Output : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 7. Interface Function : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 8. LCD Uniformity : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 9. ESD test : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |
| 10. Others : | <input type="checkbox"/> Pass | <input type="checkbox"/> NG , _____ |

6、Summary :

Sales signature : _____

Customer Signature : _____

Date : ____ / ____ / ____